Ontario Geological Survey

Northern Ontario
Engineering Geology Terrain Study 39

GULLIVER RIVER AREA

(NTS 52G/SW)

Districts of Kenora and Rainy River

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Map 5064 (coloured) – Northern Ontario Engineering Geology Terrain Study, Data Base Map, Gulliver River (NTS 52G/SW). Scale 1:100 000.

Map 5067 (coloured) – Northern Ontario Engineering Geology Terrain Study, Terrain Conditions for General Construction Map, Gulliver River (NTS 52G/SW). Scale 1:100 000.

Northern Ontario

Engineering Geology Terrain Study 39

GULLIVER RIVER AREA

(NTS 52G/SW)

Districts of Kenora and Rainy River

by

D.G. Mollard[1] and J.D. Mollard[2]

1.0 INTRODUCTION

This report contains an inventory of regional engineering terrain conditions in the Gulliver River map-area, Districts of Kenora and Rainy River. The area, which covers NTS block 52G/SW, lies between Latitudes 49°00'N and 49°30'N and Longitudes 91°00'W and 92°00'W. The report forms part of a series of publications that provide similar terrain data for some 370 000 km^2 of northern Ontario.

The purpose of the inventory is to assist regional engineering and resource planning studies at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5064, accompanying this report). The Terrain Conditions

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for General Construction Map (OGS Map 5067, accompanying this report) is a derived map which illustrates the suitability of the terrain in the Gulliver River area for such activities as foundation construction, excavation, and road construction.

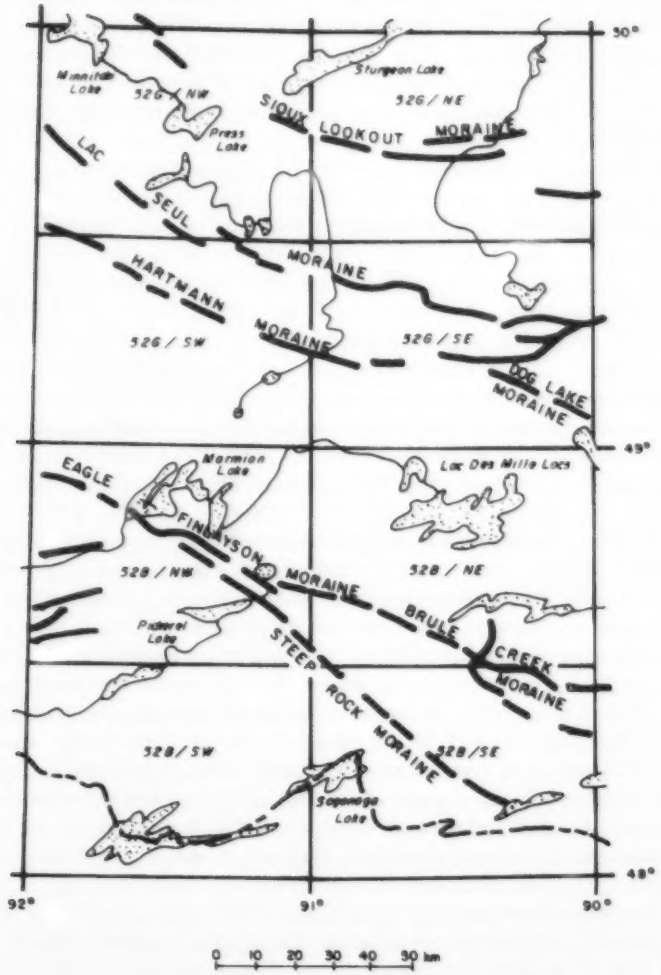
Interpretation of black and white aerial photographs, at a scale of approximately 1:50 000, formed the basis of the terrain mapping process. The interpretation was checked against published and unpublished maps and reports which documented previous field visits and observations. During the fall of 1978, roads in the map-area were traversed and observed terrain conditions recorded as further verification of the office studies. Thus, the Data Base Map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further discussion on the mapping techniques, legend format, and possible uses of this engineering geology information is available in the Ontario Engineering Geology Terrain Study Users' Manual (Gartner, Mollard, and Roed, 1980), a companion publication to this series of maps and reports.

2.0 PHYSIOGRAPHY AND GEOLOGICAL SETTING

Local relief in the Gulliver River map-area is almost always less than 75 m and generally less than 50 m. The Hartman Moraine is the most prominent glacial feature in this map-area. Highway 17 and the Canadian Pacific main line follow this moraine quite closely for a considerable distance. Many lakes occur in that part of the area which lies south of the Hartman Moraine (Figure 1). Relief is generally higher in this part of the area and controlled to a greater extent by bedrock. Lakes are irregular in shape, and their long axes trend in a northeasterly direction, generally parallel to the grain of the bedrock structure.

Thicker drift deposits occur close to the Hartman Moraine, particularly to the north of it. Lakes in areas of thicker glacial drift generally have more regular outlines than those in areas of bedrock-controlled topography. Large deposits of sand and gravel occur north and south of the Hartman Moraine. Esker deposits occur mainly to the north of this feature.



NOTE: Moraine segments shown in the figure do not necessarily all occur on the Data Base Map accompanying this report.

FIGURE 1 - MAP SHOWING MAJOR MORAINES IN NTS 52B AND 52G (MODIFIED FROM ZOLTAI 1965, FIGURE 3)

Felsic igneous and metamorphic rocks (mainly granites and gneisses) underlie most of the map-area. Belts of metavolcanics and minor metasediments occur in the northwestern and southeastern parts of the area. Varying thicknesses of glacial material overlie rough bedrock surfaces south of the Hartman Moraine; in many parts of this bedrock-dominated terrain, the overburden is so thin that it has little engineering or planning significance.

3.0 ENGINEERING TERRAIN UNITS

The engineering terrain units mapped are identified in terms of four components: surface material, landform, topography, and drainage. Format of the legend used in the terrain mapping is described in detail in the Users' Manual (Gartner, Mollard, and Roed 1980). Landform is a very important component because surface and near-surface materials, topographic expression, and the surface and internal drainage conditions, are all related to it. Consequently, the engineering terrain units are grouped, for descriptive purposes, according to the dominant landform.

A particular landform can occur as the only component in a simple terrain unit, or as a dominant or subordinate component in a complex terrain unit. The dominant landform usually occupies more than half of a complex terrain unit. Where only one subordinate landform is shown, it usually occupies between 10 and 50 percent of the complex unit. Where two subordinate landforms are shown, the first covers the larger area. Landforms that occupy less than 10 percent of the terrain in a complex unit are rarely indicated in the terrain unit letter code. Where two or three landforms in a complex terrain unit consist of the same material, the landform letter symbols are connected by a dash. Examples of terrain unit letter codes which may occur in this map-area, and an explanation of each, are given in the Appendix.

A large number of complex terrain units has been mapped due to the widespread occurrence of irregular topography. Bedrock, which is situated at or near the ground surface throughout much of the map-area, controls the topography and therefore the surface drainage conditions. Resource development and engineering planning considerations are complicated by these complex conditions.

Noteworthy occurrences of important landforms are described with respect to location, typical materials, topography, and drainage; their

significance in geotechnical investigations, regional engineering planning, and resource development is summarized.

3.1 BEDROCK KNOB (RN)

3.1.1 Description

Bedrock knob landscape (RN) is characterized by an irregular bedrock surface having complex multiple slopes of varying steepness. The cover of glacial deposits overlying the bedrock knobs is generally thin and discontinuous. Much of the glacial overburden consists of bouldery, sand-rich till that was transported only a short distance by the ice.

3.1.2 Occurrence

Exposed and near-surface bedrock knobs (RN) dominate the part of the map-area lying southwest of the Hartman Moraine (Figure 1). North of this moraine, the thicker drift cover reduces the amount of exposed bedrock. Local relief in bedrock knob terrain is mostly high, with a few areas of moderate relief. The unit is generally dry. Locally, thin deposits of ground moraine till (MG) mantle the bedrock knobs; these areas are mapped as RN(MG/R). Bedrock-controlled lineaments in this terrain are expressed as linear depressions which often contain water and deposits of peat. The bedrock knob unit occurs most commonly in areas underlain by felsic igneous and metamorphic rocks.

3.1.3 Engineering and Planning Significance

Two principal engineering considerations are the large volumes of rock that must be excavated during construction and the generally uniform and solid foundation conditions at shallow depths. However, due to difficult topography and the existence of rock fractures, bedrock knob terrain is considered poor for most types of light construction and for waste disposal. Drilling and blasting are required during the construction of almost all types of engineering works.

3.2 BEDROCK PLAIN (RP)

3.2.1 Description

The *bedrock plain unit* (RP) has a low-lying, undulating to rolling sur-

face. The bedrock is mantled by a thin and variable cover of glacial materials, consisting mainly of boulder-rich, sandy till. The rock plains display considerable local variation. They may consist of bare bedrock or may be covered by fine-grained water-laid deposits.

3.2.2 Occurrence

A bedrock plain (RP), located west of Raleigh Lake in the northwest corner of the Gulliver River map-area, includes subordinate amounts of glaciofluvial outwash (GO, GO/R) and organic terrain (OT).

3.2.3 Engineering and Planning Significance

Engineering and construction problems relate mainly to the cost of bedrock excavation. Foundation materials are strong, have a low compressibility, and a permeability that is controlled almost entirely by rock fractures. Bedrock plains are poor construction and waste disposal sites, but are still considered better than areas mapped as bedrock plateau (RL), bedrock knobs (RN), or bedrock ridges (RR). Drainage courses tend to follow eroded zones of weakness in the underlying bedrock. Many of these depressions occupy preglacial channels that were enlarged by glacial erosion. A large proportion of the ground water in this landform is confined to fractures in the upper 45 to 60 m of bedrock. Permeability varies from impervious to highly pervious, depending on the spacing, depth, and width of fissures in the bedrock. Rock materials have high compressive, shearing, and bearing strengths. Position of the water table varies with topography, being closer to the surface beneath depressions. By careful route selection and proper design of vertical alignment, rock cuts on lower class roads can be avoided or at least the volume of rock to be blasted can be minimized. This is possible because of the low relief surfaces of the bedrock plains.

3.3 BEDROCK RIDGE (RR)

3.3.1 Description

The *bedrock ridge unit* (RR) consists of long, narrow, subparallel and intersecting bedrock ridges of varying height. Thickness of drift over the masked bedrock surface varies substantially over short distances. In general, it is relatively thin (1 to 2 m) on ridge tops and thicker on the lower slopes and in the depressions between rock ridges.

3.3.2 Occurrence

Large expanses of bedrock ridge terrain occur in the Gulliver River map-area, particularly in the southeastern and south-central parts. The rocks underlying this unit are often metavolcanics and metasediments. Common subordinate landforms are bedrock knobs (RN) and ground moraine till as a thin mantle overlying bedrock (MG/R).

3.3.3 Engineering and Planning Significance

The main construction problem is the large quantities of very hard rock that often must be excavated during construction. Drilling and blasting costs can be very high. Bedrock ridge terrain is considered poor for most types of engineering, construction, and resource development. It also has a low rating for waste disposal due to irregular relief, the presence of rock fractures near the ground surface, and the high cost of earthwork construction.

3.4 END MORAINE (ME)

3.4.1 Description

End moraine (ME), which forms either prominent or inconspicuous till ridges, was deposited along the margin of the glacier. Although the ridges are usually long and narrow, they can be hummocky in places. End moraine consists largely of ice-deposited till and boulders, with minor inclusions of water-laid silt, sand, and gravel. Segments of end moraine, composed mainly of till, occur with hummocky moraine (MH), kames (GK), and ice-contact deltas (GD) in large moraine complexes which are identified by name in Figure 1. The bedrock surface is nearly always buried in areas of end moraine; there are exceptions, however, and in a few places end moraine ridges have a core of solid rock.

3.4.2 Occurrence

End moraine bouldery till (ME) is found only within the Hartman and Lac Seul Moraines in the Gulliver River map-area (Figure 1). In the Hartman Moraine, particularly in Burt, Cathcart, and McNevin Townships in the eastern part of the map-area, end moraine occurs in association with hummocky moraine (ME-MH). End moraine is mapped as a

subordinate landform in a kame-outwash complex associated with the central part of the Hartman Moraine. It also occurs as a subordinate landform in a kame unit associated with the Lac Seul Moraine in the northeastern part of the area. Parts of some end moraines reach an elevation of 500 m, but most end moraines occur at elevations lower than this.

3.4.3 Engineering and Planning Significance

An important characteristic of end moraine is their variability. Layers of unsorted and unstratified material of varying sizes, can both underlie and overlie sequences of layered silt, sand, and gravel. In general, the boulder content of this landform is high. End moraines in the map-area commonly exhibit variable permeability and internal drainage, low compressibility, and high bearing strength. The water table is low in end moraine ridges. Where the unit consists of till that is high in sand- and gravel-sized material, and where sources of stratified sand and gravel are scarce, the coarse till may sometimes be crushed and used as a source of road-surfacing material. End moraines may present excavation difficulties during the building of roads and structures due to the abundance of small and large boulders.

3.5 GROUND MORAINE (MG)

3.5.1 Description

The term *'ground moraine'* (MG) refers to an extensive deposit of till forming an undulating to rolling plain. Although till is generally composed of an assortment of particle sizes (including clay, silt, sand, gravel, cobbles, and boulders), till deposits in this map-area have a high boulder content. The thickness of till in ground moraine varies from less than 1 m to many tens of metres; The landform is mapped as MG where the till is thick enough to mask any topographic effect of underlying bedrock. In general, the till layer forms a mantle less than 3 m thick over the bedrock and is mapped as MG/R. Till in ground moraine tends to be thicker in bedrock depressions and thinner over bedrock ridges and knobs.

3.5.2 Occurrence

Few thick deposits of ground moraine (MG) are found in the Gulliver River map-area. Where ground moraine is shown, it commonly occurs as a veneer less than 3 m thick overlying the bedrock. Such areas are mapped either as MG/R or MG/RP. In general, examples of the former unit are found northeast of the Hartman Moraine, where the cover of glacial drift over the bedrock is more extensive. Southwest of the Hartman Moraine, ground moraine as a thin mantle overlying bedrock occurs (1) as a dominant landform in the vicinity of White Otter Lake, or (2) as a subordinate landform in rock knob or rock ridge terrain. A layer of loess, approximately 1 m in thickness, covers much of the ground moraine in the Gulliver River map-area.

3.5.3 Engineering and Planning Significance

The till in ground moraine is coarse and bouldery, and has moderate permeability and internal drainage, low compressibility, and high bearing strength. Water table position varies with relief, being lower beneath knolls and low ridges and higher beneath depressions. The till in many of the depressions is covered by thin deposits of peat and muck.

The suitability of ground moraine for road and other light foundation construction is fair to good. The fact that the till often forms only a thin mantle over the bedrock (MG/R) has a great deal of significance in road building. Road construction through this type of terrain is difficult owing to the bouldery nature of the till and the probability of encountering bedrock in cuts. The suitability of ground moraine for waste disposal varies from poor to fair.

3.6 HUMMOCKY MORAINE (MH)

3.6.1 Description

Although some hummocky moraine deposits formed along an active ice front, most of the sediments which make up this landform accumulated on the surface of stagnant glacial ice. In time, the buried ice melted and deposited a layer of unsorted till and, in places, washed glacial debris. Most hummocky moraine consists of steep-sided knobs and short ridges separated by undulating to flat plains and swampy kettle hole basins.

Soil materials in hummocky moraine include till, usually as the dominant constituent, and subordinate amounts of stratified silt, sand, and gravel in pockets or lenses. Hummocky moraine can be very bouldery. Scattered kames (GK) are a common subordinate landform.

3.6.2 Occurrence

A fairly large expanse of hummocky moraine (MH) occurs in the vicinity of Raleigh Lake in the northwestern part of the Gulliver River map-area. The only other occurrence of hummocky moraine is as a subordinate landform in a kame-outwash complex (GK-GO (MH) (RN)) associated with the Hartman Moraine on the eastern margin of the map-area.

3.6.3 Engineering and Planning Significance

Engineering considerations include the large quantities of material that may have to be excavated during construction, a high content of boulders, and rapid changes in the nature of the materials. Pockets of sand and gravel constitute small sources of construction material of variable quality.

Although variable, most areas of hummocky moraine have moderate permeability and internal drainage, low compressibility, high bearing strength, and low shrink-and-swell potential. In depressions, the till deposits are commonly covered by thin, water-laid silt and clay, which in turn are overlain by peat and muck deposits. Hummocky moraine is considered fair to poor for general construction purposes and for waste disposal.

3.7 ICE-CONTACT DELTA (GD)

3.7.1 Description

Esker deltas, kame deltas, and delta moraines are all varieties of the ice-contact delta. Some are quite large in area and important in terms of the volume of recoverable sand and gravel which they contain. Individual beds, consisting mainly of sand or gravel, are usually better sorted, cleaner, and less variable than stratified deposits in esker (GE) and kame (GK) landforms. The beds in this unit are also typically less folded and faulted and are more continuous. It is worth noting that materials in

many ice-contact deltas are coarse (*i.e.* gravelly) on the north and northeast sides and finer (*i.e.* sandy) on the south and southwest sides. These conditions indicate the parts of the delta which were, respectively, closest to and farthest from the glacial front against which the delta was built.

3.7.2 Occurrence

Several small ice-contact deltas are fond in the Gulliver River map-area. A moderately large deposit is located south of Notman Lake in Skey Township. Other ice-contact deltas are located (1) east of McNamara Lake in the northwest-central part of the area, (2) west of Doan Lake in the south-central part, (3) northeast of White Otter Lake in the southwestern part, and (4) north of Clearwater West Lake in the southwest corner. Most ice-contact deltas occur between elevations of 440 and 465 m. The smaller deltas, located farther from the Hartman Moraine, were formed at elevations well below that of the moraine.

3.7.3 Engineering and Planning Significance

Ice-contact deltas are good potential sources of concrete and blacktop aggregate. They are also favorable sites for the construction of airstrips, roads, and other types of engineering works. Because the subsoils are highly permeable, deltaic landforms are relatively poor areas for waste disposal. Larger deposits, however, are generally good ground water prospects, especially where sand and gravel horizons are thick and extend below the water table. Ice-contact deltas possess high bearing strength and good workability in wet weather. Slopes are stable and subsoils are well drained. Away from the steeply sloping margins of this landform, earthwork volumes and excavation costs are normally low. Reservoirs and sewage lagoons in ice-contact deltas must be lined to prevent excessive leakage.

3.8 ESKERS (GE)

3.8.1 Description

The ridged landform represented by the esker symbol (GE, >>>) also includes crevasse fillings. Both occur as long, narrow, sand and gravel ridges that can be winding or straight and may widen in places. Some of

these elongate ice-contact stratified drift ridges exhibit braided, branching, beaded, and kettled segments. Most of the ridges trend roughly parallel to the last direction of the glacial flow. The cores of many eskers and crevasse fillings contain complexly layered units, consisting of sandy gravel and gravelly sand, that exhibit collapse structures (*i.e.* folds, faults, and pinch-outs of strata). Some silty and fine sand units (water-laid), boulders, and till pockets may occur within the central parts of eskers and crevasse fillings, as well as along their flanks.

3.8.2 Occurrence

Eskers are common northeast of the Hartman Moraine (Figure 1). Most trend in a northeasterly direction and terminate at the moraine. An exception is the esker located west of Upper Scotch Lake in the eastern part of the map-area. Some of the large eskers are several kilometers in length, but are segmented and, therefore, discontinuous. Sand and gravel pits have been developed in some of the eskers.

3.8.3 Engineering and Planning Significance

Eskers and crevasse fillings are relatively small and isolated landforms in this map-area, and are generally inferior to ice-contact delta and glacial outwash deposits as sources of good quality granular construction materials. Typically, the unit possesses high permeability and good internal drainage, low compressibility, high bearing strength, low frost susceptibility, and low shrink-and-swell potential. Where esker ridges are steep-sided, narrow, and winding, they may be unsuitable for use as transportation routes. They may trend in the wrong direction for route location purposes, but, in regions that are dominated by large expanses of swamp and bedrock, eskers are frequently considered as good route location possibilities. Where the sand and gravel in large eskers extends many metres below the water table, the unit represents a potential source of ground water for domestic and, possibly, municipal and industrial use.

3.9 KAME (GK)

3.9.1 Description

Kames occur either as steep-sided single knobs or as clusters of several knobs in kame fields and kame moraine. The larger, steep-sided kames

usually have an irregular surface; in a few places, they contain deep kettle hole depressions. Most are composed of complexly interbedded sand and gravel strata which regularly exhibit fold, fault, and pinch-out structures. Kames also contain variable but usually minor amounts of silt, till, and boulders. Large kame deltas are discussed in Section 3.6; kame terraces are rare.

3.9.2 Occurrence

Most of the glaciofluvial deposits mapped as kames (GK) form part of the Hartman and Lac Seul Moraines or are located near them (Figure 1). This landform commonly occurs in association with end moraine (ME) or glaciofluvial outwash (GO), or may form a thin mantle over bedrock (GK/R). Those sections of the Hartman Moraine which are mapped as kame lie at elevations of 460 to 485 m. Numerous boulders are common on the surface of many kame moraines. Individual kames sometimes occur considerable distances from major moraine ridges. An extensive kame-outwash complex (GK-GO) is located along the east side of White Otter Lake. Other landforms associated with this complex are bedrock knobs (RN) and eskers (GE).

3.9.3 Engineering and Planning Significance

In general, kames have high permeability and good internal drainage, low compressibility, high shear strength, and good bearing capacity. Position of the water table varies with relief, being nearer the surface beneath kettle depressions and deeper beneath ridges and knobs. Although the granular materials in kames provide good foundations for buildings and small engineering works, the quantities of material that must be excavated during construction can be moderately high. Waste disposal sites require special design procedures and costly construction in order to function properly. Kames should be avoided as waste disposal sites. They vary from poor to good as sources of sand and gravel aggregate, depending upon their size and compositional variability.

3.10 OUTWASH PLAIN (GO)

3.10.1 Description

Outwash deposits include plains, fans, deltas, and valley trains of varying sizes, all consisting mainly of sand and gravel. Most outwash sediments

were drained from the front of a melting glacier and accumulated in flooded lowlands and valley bottoms. Although most outwash deposits formed in proglacial positions, some accumulated over masses of stagnant glacier ice, resulting in pitted or kettled surfaces. Outwash landscapes that show abandoned channel scars, braid bars, or deep kettle holes are commonly coarse in texture (*i.e.* gravelly and cobbly rather than sandy).

3.10.2 Occurrence

Two large outwash plains (GO) occur in the Gulliver River map-area. A strip of outwash 1 to 2 km in width is located on the southwest side of the Hartman Moraine (Figure 1). This deposit follows the front of the moraine and is bordered on the south by a meltwater channel, which is occupied in places by the Gulliver River. Another large outwash plain is located northeast of the Hartman Moraine. This deposit covers most of northeastern and north-central parts of the map-area, and occurs on both sides of the Lac Seul Moraine (Figure 1).

Relief on these outwash deposits is generally low and elevations range from 435 to 455 m. In places, the deposits are covered by a thin mantle of organic material (OT/GO). A layer of loess, 1 m or more in thickness, covers the eastern two-thirds of the map-area, to the south of the Hartman Moraine.

3.10.3 Engineering and Planning Significance

Outwash landforms almost always have high permeability and good internal drainage, low to very low compressibility, low shrink-and-swell tendencies, and high shear strength and bearing capacity, particularly where these granular deposits are confined. Granular materals in outwash landforms form stable slopes and are seldom susceptible to frost heave. Being level and well drained, the sediments in outwash plains are not easily eroded by running water. The boulder content is generally low. A high water table can be expected beneath kettle depressions. Extensive outwash plains provide excellent sites for the construction of roads and airstrips, and are often good sources of concrete and bituminous aggregate. They are good potential sites for ground water development, particularly where the granular deposits are deep and are recharged by water from nearby lakes and rivers.

3.11 ALLUVIAL PLAIN (AP)

3.11.1 Description

Many alluvial deposits (AP) in this map-area consist of fine and medium sand at depth; these materials are commonly overlain by a silty upper stratum of variable thickness. Oxbows and abandoned channel segments occur where meandering streams cross landforms composed largely of loose silt and fine sand. Sediments beneath alluvial plains are finer textured where the material being carried by the stream was eroded from clay and silty clay glaciolacustrine deposits. The landform includes flood plains that have been eroded in till and are strewn with boulders, as well as segments of stream valleys where alluvial sediments range in texture from coarse sand to coarse gravel and cobbles. Long and complex alluvial plain systems sometimes include three constituent landforms: low alluvial terraces, alluvial flood plains, and stream channels.

3.11.2 Occurrence

Alluvial plain deposits (AP) are small and few in number in the Gulliver River map-area. The most extensive deposits occur along the Gulliver River in the central and northern parts of the area. Where the river follows the margin of the outwash southwest of the Hartman Moraine, organic material overlies most of th alluvial flood plain deposits, which probably consist largely of silt and fine sand. Sizeable alluvial plains also occur along the Bonheur and Megikons Rivers in the northeastern part of the area; the alluvial deposits along the latter are covered by a thin mantle of organic material. Smaller alluvial plains occur along (1) the Osaguan River in the northwestern part of the area, (2) the Scotch River in Corman Township near the eastern margin of the area, and (3) the Seine River in the southeast corner.

3.11.3 Engineering and Planning Significance

Alluvial plains are subject to flooding. The water table is usually situated at or near the surface for much of the year; organic-filled depressions are common. Although some alluvial terraces, flood plains, and channel bottoms represent potential sources of sand and gravel for construction purposes, the high water table may cause problems during excavation of such materials. This landform is generally unsuitable for transportation

routes, general construction, or waste disposal sites because of the high water table and risk of flooding.

3.12 SAND DUNES (ED)

3.12.1 Description

Dunes are composed of fine and medium sand that has been blown into ridges by wind action. Dune ridges range in height from 1 or 2 m to more than 5 m, and may be long, narrow, and straight or arrowhead or arcuate in outline. Dunes usually overlie or occur downwind from sandy outwash plains and sandy glaciolacustrine plains.

3.12.2 Occurrence

Dune sand occur east and west of Downhill and Wabuska Lakes in the north-central part of Gulliver River map-area. They were derived mainly from the fine and medium sand in outwash deposits. Where closely spaced dunes overlie outwash, the terrain is mapped as ED/GO; where the dunes are widely spaced, the unit is mapped as GO(ED). Small patches of organic material occur in the dune terrain.

3.12.3 Engineering and Planning Significance

Sand dunes possess special characteristics which are of engineering significance. When denuded of vegetation, the fine and medium sand in dune ridges is susceptible to wind erosion and drifting. A moderate to low water table can be expected beneath higher dune ridges. Dune are well drained, and the sand of which they are composed has a low strength when it is not confined. These deposits usually have low compressibility unless sand of a relatively uniform grain size has been deposited in a very loose state. Where dune sand is loose, generally beneath the slip face, it may possess a moderate to low relative density. The bearing strength of dune material is also low where the sand is unconfined, but can increase with the degree of confinement. Caving of wet and dry sand in vertical ditch walls is a potential problem which can increase costs on major construction jobs. Dune sand is nonplastic and is generally not susceptible to frost action or shrinking and swelling. Dunes provide a good source of sub-base material for highway pavement structures. Moreover, dune terrain can usually be worked in wet weather.

3.13 ORGANIC TERRAIN (OT)

3.13.1 Description

Organic terrain inclues varying depths of peat and muck in marshes, swamps, fens,and bogs. No attempt was made to separate these organic landscape types during the mapping. Although peat and muck deposits usually occur as relatively thin surficial layers, in places these organic materials can be several metres thick. Moreover, the thickness of the deposits can change drastically over very short distances.

3.13.2 Occurrence

Large areas of organic terrain are located north of the Hartman Moraine (Figure 1). They occur extensively in all areas covered by thick drift. The peat and muck deposits are generally thin due to the gently undulating character of the terrain. In places, the organic materials occur as a thin surface layer over glaciofluvial outwash (OT/GO) or alluvial plains (OT/AP).

Large peat deposits occur either alone or in association with glaciofluvial outwash along the south side of the Hartman and Lac Seul Moraines (Figure 1). Organic terrain is less common in the part of the map-area lying south of the Hartman Moraine; where it does occur, the peat usually fills deep basins between bedrock knobs and ridges.

3.13.3 Engineering and Planning Significance

Although organic deposits are commonly thin, they are nonetheless very poor foundation and construction materials. The water table is at or near ground surface for most of the year. The locations of deeper pockets of organic material are difficult to predict reliably without extensive test-drilling. The topography of organic terrain is level or slightly depressional. Peat and muck deposits have low shear and bearing strengths and generally low permeability. They are nearly always poorly drained, highly compressible, and are subject to seasonal flooding. Consequently, they are unsuitable sites for nearly all types of engineering works and for waste disposal.

4.0 EXAMPLE OF DERIVED MAP: TERRAIN CONDITIONS FOR GENERAL CONSTRUCTION

The Terrain Conditions for General Construction Map (OGS Map 5067) included in the report has been derived from the Data Base Map (OGS Map 5064, accompanying this report). The purpose of this derivative map is to illustrate how the basic terrain data can be used for general engineering and construction purposes.

Typical projects that fall under the category of general construction include location and construction of highways, overhead transmission lines, timber storage sites, town sites, work camp sites, cottage subdivisions, and airfields.

Reference should be made to the "Ontario Engineering Terrain Study Users' Manual" (Gartner, Mollard, and Roed 1980) for further information on the preparation and use of the various types of derivative maps.

4.1 Capability Rating Criteria

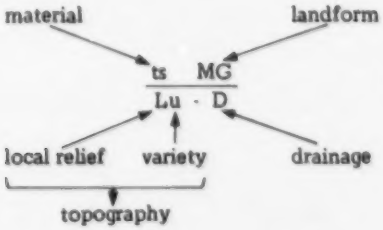
Criteria for rating the capability of a terrain unit for engineering uses are related to landform type, engineering properties of the constituent materials, and associated topography and drainage conditions. A section on the engineering and planning significance of each landform group is provided in this report. This information can be used to rate the capability of landforms for general construction or other engineering uses. In addition to the above, the marginal notes on the Terrain Conditions for General Construction Map outline the engineering criteria used in rating the terrain units for general construction capability.

5.0 APPENDIX: EXAMPLES OF TERRAIN UNIT LETTER CODES:

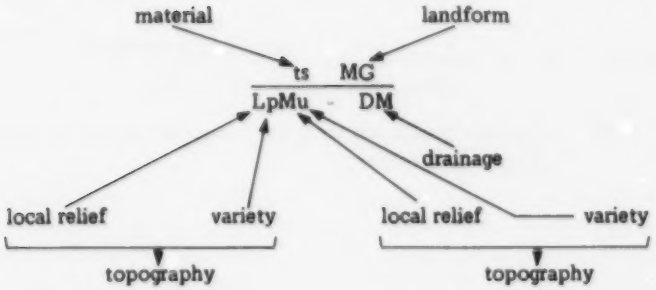
The engineering terrain unit letter codes consist of four components: surface materials, landform, topography, and drainage. The format of the letter codes used in describing the terrain units is discussed in detail in the Users' Manual (Gartner, Mollard, and Roed 1980). Some additional examples of the letter codes are as follows:

5.1 SIMPLE TERRAIN UNIT:

Example 1:



Example 2:

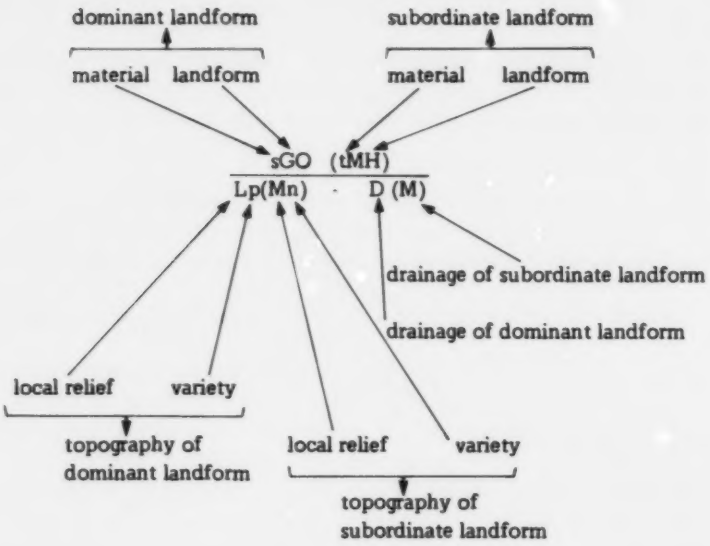


Note: The above type of letter code is used where there are two distinctly different types of topography and/or drainage in a simple terrain unit.

5.2 COMPLEX TERRAIN UNIT:

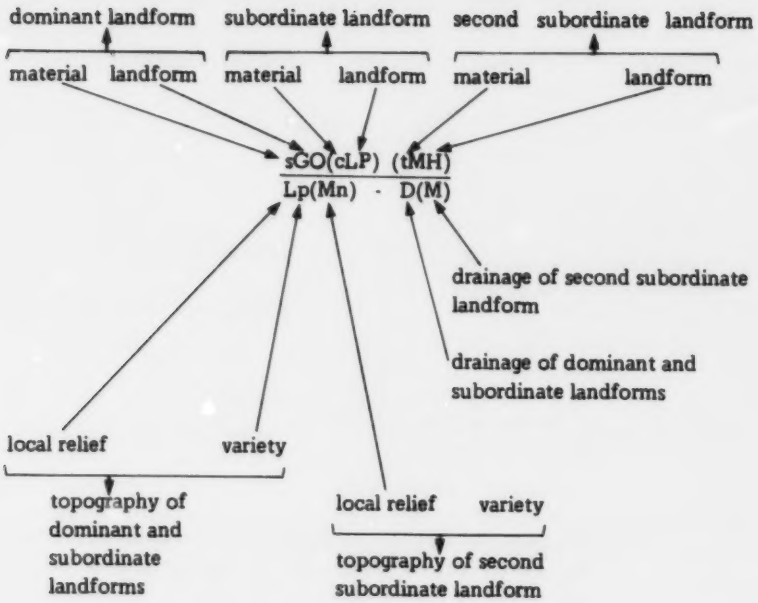
In complex areas, the dominant landform is shown first and the subordinate landform(s) appear in parentheses.

Example 1:



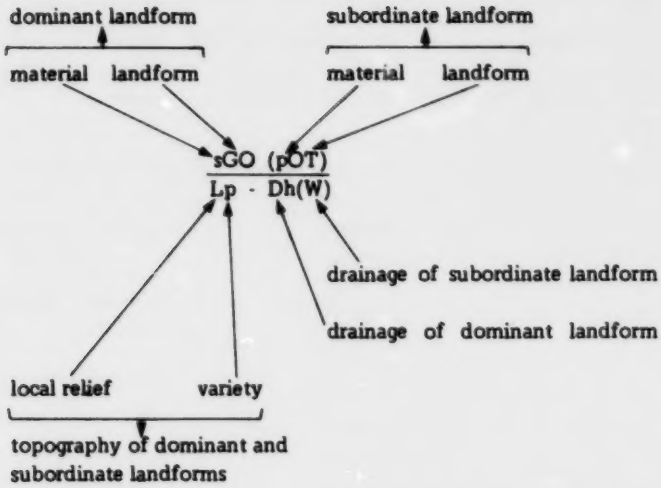
Note: The topography and drainage in parentheses refer to the landform shown in parentheses.

Example 2:



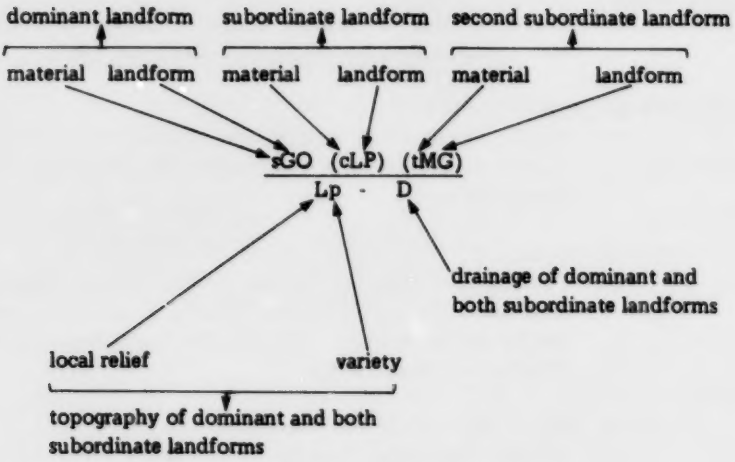
Note: The topography and/or drainage in parentheses refer to the second subordinate landform (in parentheses).

Example 3:



Note: If topography or drainage is similar in the dominant and subordinate landforms, then no topography or drainage symbol is shown in parentheses and the symbol shown applies to both landforms. If topography or drainage conditions are different in one of the landforms, a topography or drainage symbol is shown in parentheses to indicate this difference.

Example 4:



Note: Where topography and drainage conditions are similar in all of the landforms shown, no topography or drainage symbols are placed in parentheses.

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MAPS
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